ADVANCE INFORMATION

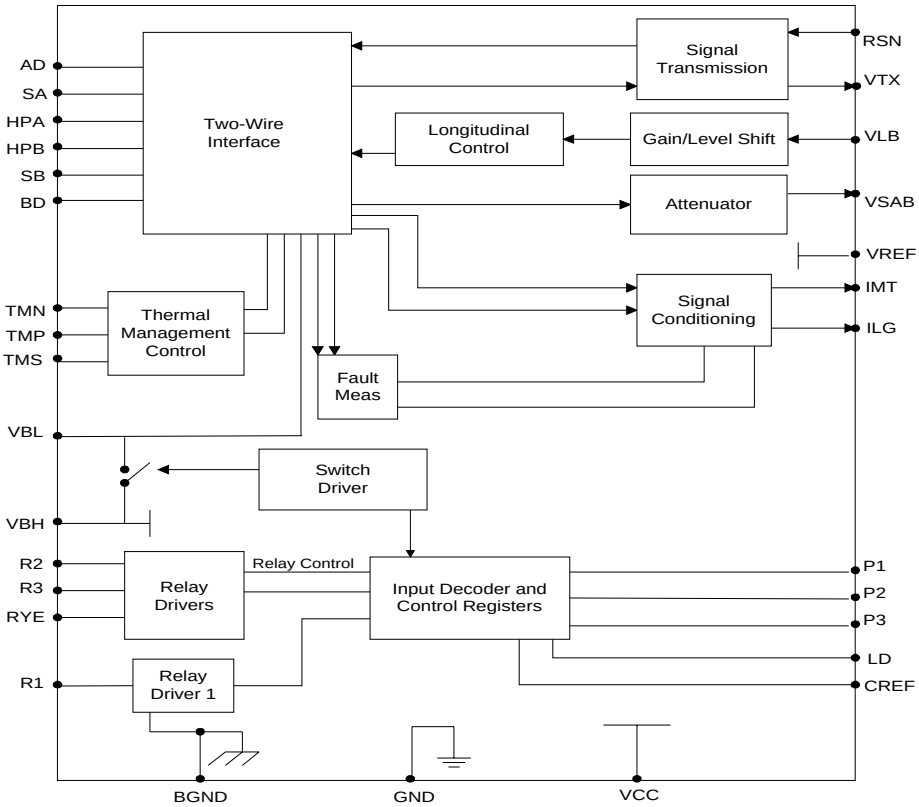
Am79R241

Intelligent Subscriber Line Interface Circuit (ISLIC™)

DISTINCTIVE CHARACTERISTICS

- **Monitor of two-wire interface voltages and currents supports**
  - — Voice transmission
  - — Through chip ring generation
  - — Programmable DC feed characteristics
    - — Independent of battery
    - — Current limited
  - — Selectable off-hook and ground-key thresholds
  - — Subscriber line diagnostics
    - — Leakage resistance
    - — Loop resistance
    - — Line capacitance
    - — Bell capacitance
    - — Power cross and fault detection
    - — Foreign voltage sensing
- **Supports internal and external ringing**
- **+5 V and battery supplies**
- **Dual battery operation for system power saving**
  - — Automatic battery switching
  - — Intelligent thermal management
- **Compatible with inexpensive protection networks**
  - — Accommodates low tolerance fuse resistors or PTC thermistors
- **Metering capable**
  - — 12 kHz and 16 kHz
  - — Smooth polarity reversal
- **Tip-open state supports ground start signaling**
- **Integrated test load switches/relay drivers**

BLOCK DIAGRAM



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The Am79R241, in combination with an ISLAC™ device, implements the telephone line interface function. This enables the design of a low cost, high performance, fully software programmable line interface for multiple country applications worldwide. All AC, DC, and signaling parameters are fully programmable via microprocessor or GCI interfaces on the ISLAC device. Additionally, the Am79R241 device has integrated self-test and line-test capabilities to resolve faults to the line or line circuit. The integrated test capability is crucial for remote applications where dedicated test hardware is not cost effective.

DISTINCTIVE CHARACTERISTICS OF THE INTELLIGENT ACCESS VOICE CHIPSET

- **Performs all battery feed, ringing, signaling, hybrid and test (BORSCHT) functions**
- **Two chip solution supports high density, multi-channel architecture**
- **Single hardware design meets multiple country requirements through software programming of:**
  - — Ringing waveform and frequency
  - — DC loop-feed characteristics and current-limit
  - — Loop-supervision detection thresholds
    - — Off-hook debounce circuit
    - — Ground-key and ring-trip filters
  - — Off-hook detect de-bounce interval
  - — Two-wire AC impedance
  - — Trans-hybrid balance
  - — Transmit and receive gains
  - — Equalization
  - — Digital I/O pins
  - — A/μ-law and linear selection
- **Supports internal and external ringing**
  - — Self-contained ringing generation and control
  - — Supports external ringing generator and ring relay
  - — Ring relay operation synchronized to zero crossings of ringing voltage and current
  - — Integrated ring-trip filter and software enabled manual or automatic ring-trip mode
- **Supports metering generation with envelope shaping**
- **Smooth or abrupt polarity reversal**
- **Adaptive transhybrid balance**
  - — Continuous or adapt and freeze
- **Supports both loop-start and ground-start signaling**
- **Exceeds LSSGR and CCITT central office requirements**
- **Selectable PCM or GCI interface**
  - — Supports most available master clock frequencies from 512 kHz to 8.192 MHz
- **On-hook transmission**
- **Power/service denial mode**
- **Line-feed characteristics independent of battery voltage**
- **Only 5 V, 3.3 V and battery supplies needed**
- **Low idle-power per line**
- **Linear power-feed with intelligent power-management feature**
- **Compatible with inexpensive protection networks; Accommodates low-tolerance fuse resistors while maintaining longitudinal balance**
- **Monitors two-wire interface voltages and currents for subscriber line diagnostics**
- **Built-in voice-path test modes**
- **Power-cross, fault, and foreign voltage detection**
- **Integrated line-test features**
  - — Leakage
  - — Line and ringer capacitance
  - — Loop resistance
- **Integrated self-test features**
  - — Echo gain, distortion, and noise
- **0 to 70°C commercial operation**
  - — –40°C to 85°C extended temperature range available
- **Small physical size**
- **Up to three relay drivers per ISLIC device**
  - — Configurable as test load switches

BLOCK DIAGRAMS

Figure 1. Example Four-Channel Linecard Block Diagram

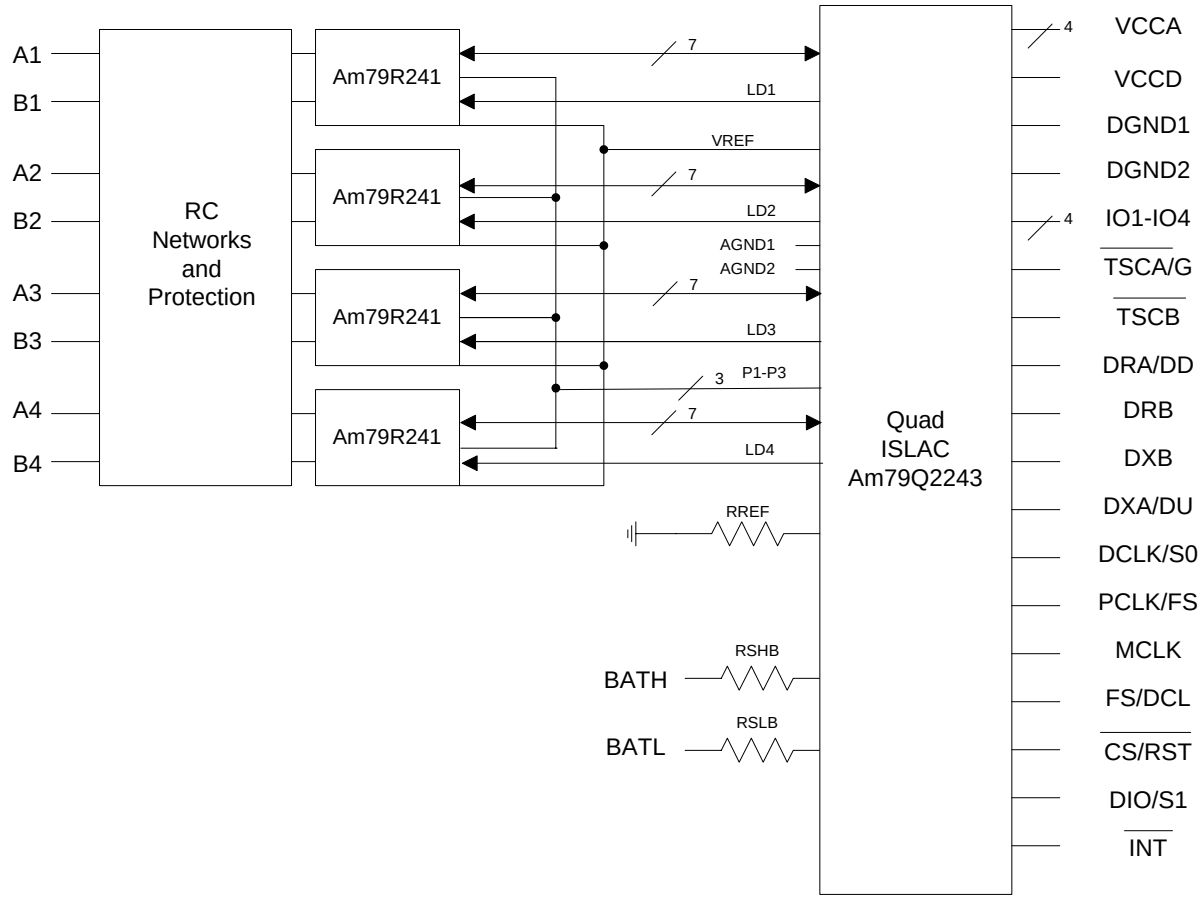
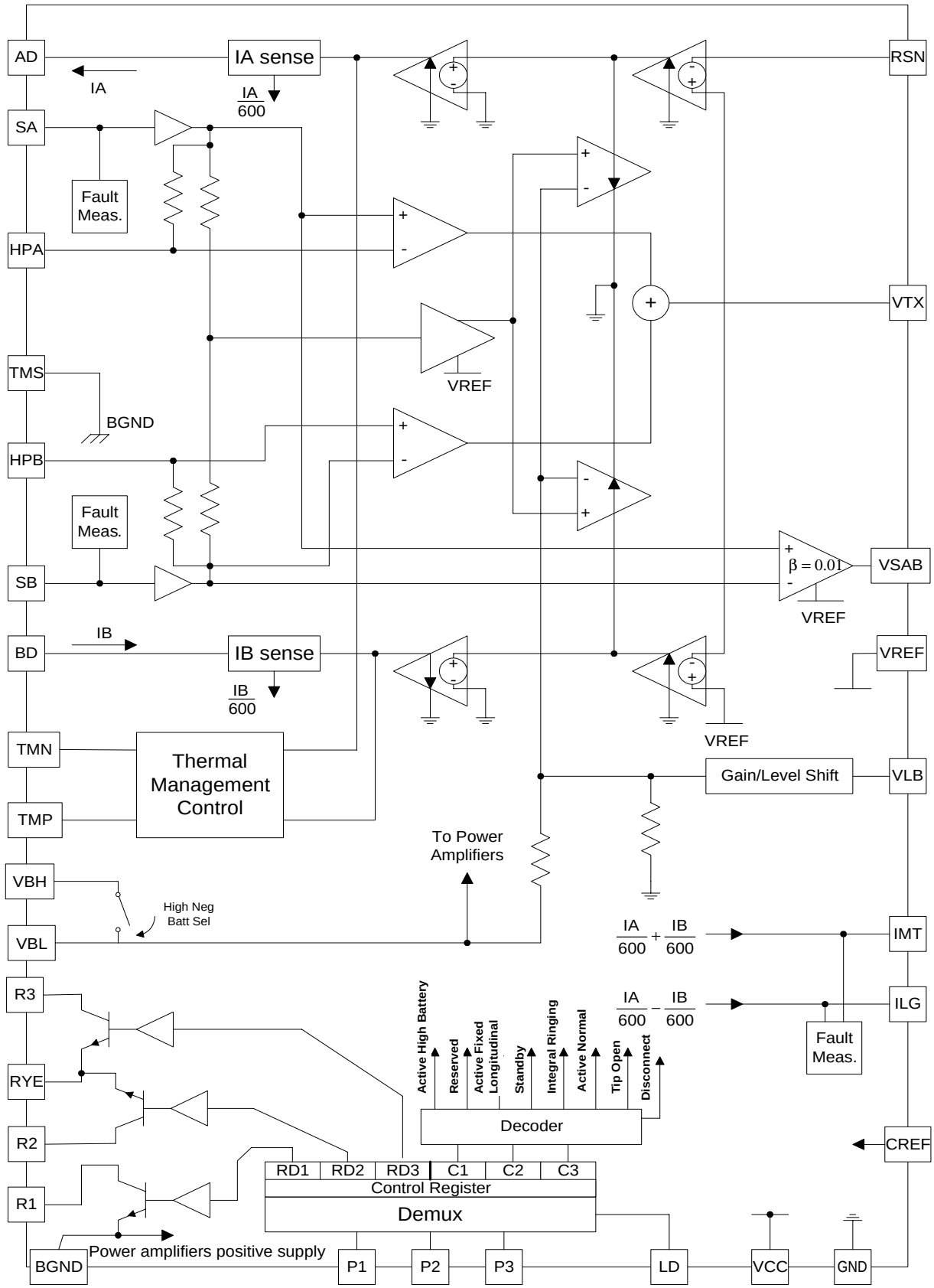
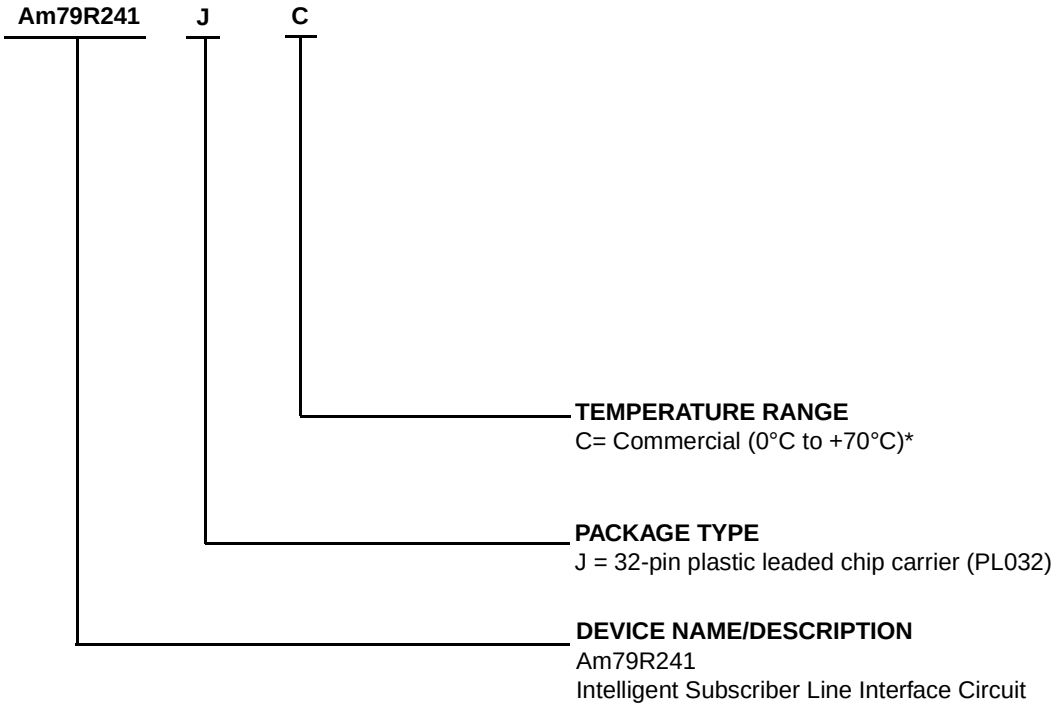


Figure 2. Am79R241 Block Diagram



ORDERING INFORMATION

AMD standard products are available in several packages and operating ranges. The ordering number (valid combination) is formed by a combination of the elements below. An ISLAC device must be used with this part.



Valid Combinations	
Am79R241	JC

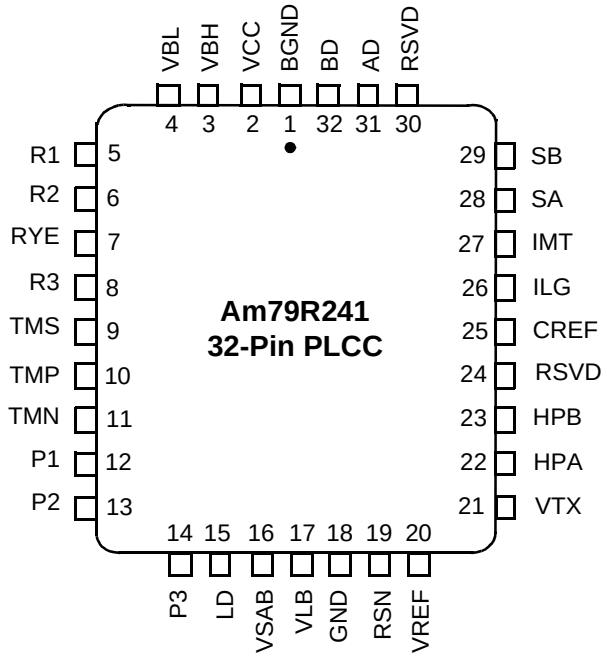
Valid Combinations

Valid combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, and to check on newly released valid combinations.

Note:

**Functionality of the device from 0°C to 70°C is guaranteed by production testing. Performance from –40°C to +85°C is guaranteed by characterization and periodic sampling of production units.*

CONNECTION DIAGRAM



PIN DESCRIPTIONS

Pin	Pin Name	I/O	Description
AD, BD	A, B Line Drivers	O	Provide the currents to the A and B leads of the subscriber loop.
BGND	Ground		Ground return for high and low battery supplies.
CREF	+3.3 VDC		VCCD reference from the ISLAC device used for current pin compliance limiting.
GND	Ground		Analog and digital ground return for VCC.
HPA, HPB	High-Pass Filter Capacitor	O	These pins connect to CHP, the external high-pass filter capacitor that separates the DC loop-voltage from the voice transmission path.
ILG	Longitudinal Current Sense	O	ILG is proportional to the common-mode line current (IAD – IBD), except in disconnect mode, which is proportional to the current into grounded SB.
IMT	Metallic Current Sense	O	IMT is proportional to the differential line current (IAD + IBD), except in disconnect mode, where IMT is proportional to the current into grounded SA.The Am79R241 indicates thermal overload by pulling IMT to +3 V.
LD	Register Load	I	The LD pin controls the input latch and responds to a 3-level input. When the LD pin is a logic 1, the logic levels on P1–P3 latch into the Am79R241 control register bits that operate the mode-decoder. When the LD pin is a logic 0, the logic levels on P1–P3 latch into the Am79R241 control register bits that control the relay drivers. When the LD pin level is at ~VREF, the control register contents are locked.
P1–P3	Control Bus	I	Inputs to the latch for the operating-mode decoder and the relay-drivers.
R1	Relay 1 Driver	O	Collector connection for relay 1 driver. Emitter internally connected to BGND.
R2	Relay 2 Driver	O	Collector connection for relay 2 driver. Emitter internally connected to RYE
R3	Relay 3 Driver	O	Collector connection for relay 3 driver. Emitter internally connected to RYE.
RSN	Receive Summing Node	I	The metallic current between AD and BD is equal to 500 times the current into this pin. Networks that program receive gain and two-wire impedance connect to this node. This input is at a virtual potential of VREF.
RSVD1	Reserved		This is used during AMD testing. In the application, this pin must be left floating.
RYE	Relay 2, 3 Common Emitter	O	Emitter connection for R2 and R3. Normally connected to relay ground.
SA, SB	A, B Lead Voltage Sense	I	Sense the voltages on the line side of the fuse resistors at the A and B leads. External sense resistors, RSA and RSB, protect these pins from lightning or power-cross.
TMP, TMN, TMS	Thermal Management		External resistors connected from TMP to TMS and TMN to VBL to offload excess power from the Am79R241.
VBH	Battery (Power)		Connection to high-battery supply used for ringing and long loops. Connects to the substrate. When only a single battery is available, it connects to both VBH and VBL.
VBL	Battery (Power)		Connection to low-battery supply used for short loops. When only a single battery is available, this pin can be connected to VBH.
VCC	+5 V Power Supply		Positive supply for low voltage analog and digital circuits in the Am79R241.
VLB	Longitudinal Voltage	I	Sets the DC longitudinal voltage of the Am79R241. It is the reference for the longitudinal control loop. When the VLB pin is greater than VREF, the Am79R241 sets the longitudinal voltage. When the VLB pin is driven to levels between 0 V and VREF, the longitudinal voltage is defined by the equations in the longitudinal control section.
VREF	1.4 V Analog Reference	I	The ISLAC chip provides this voltage which is used by the Am79R241 for internal reference purposes. All analog input and output signals interfacing to the ISLAC chip are referenced to this pin.
VSAB	DC Loop Voltage	O	Scaled-down version of the voltage between SA and SB on this pin.
VTX	4-Wire Transmit Signal	O	The voltage between this pin and VREF is a scaled down version of the AC component of the voltage sensed between the SA and SB pins. One end of the two-wire input impedance programming network connects to VTX. The voltage at VTX swings positive and negative with respect to VREF.

GENERAL DESCRIPTION

The Intelligent Access voice chipsets integrate all functions of the subscriber line. Two chip types are used to implement the linecard; an Am79R241 device and an ISLAC device. These provide the following basic functions:

1. The Am79R241: A high voltage, bipolar device that drives the subscriber line, maintains longitudinal balance and senses line conditions.
2. The ISLAC device: A low voltage CMOS IC that provides conversion, control and DSP functions for the Am79R241.

Complete schematics of linecards using the Intelligent Access voice chipsets for internal and external ringing are shown in Figure 3 and Figure 4.

The Am79R241 uses reliable, bipolar technology to provide the power necessary to drive a wide variety of subscriber lines. It can be programmed by the ISLAC device to operate in eight different modes that control power consumption and signaling. This enables it to have full control over the subscriber loop. The Am79R241 is designed to be used exclusively with the ISLAC devices. The Am79R241 requires only +5 V power and the battery supplies for its operation.

The Am79R241 implements a linear loop-current feeding method with the enhancement of intelligent Thermal Management. This limits the amount of power dissipated on the Am79R241 chip by dissipating power in external resistors in a controlled manner.

Each ISLAC device contains high-performance circuits that provide A/D and D/A conversion for the voice (codec), DC-feed and supervision signals. The ISLAC device contains a DSP core that handles Signaling, DC-feed, supervision and line diagnostics for all channels.

The DSP core selectively interfaces with three types of backplanes:

- Standard PCM/MPI
- Standard GCI
- Modified GCI with a single analog line per GCI channel

The Intelligent Access voice chipset provides a complete software configurable solution to the BORSCHT functions as well as complete programmable control over subscriber line DC-feed characteristics, such as current limit and feed resistance. In addition, these chipsets provide system level solutions for the loop supervisory functions and metering. In total, they provide a programmable solution that can satisfy worldwide linecard requirements by software configuration.

Software programmed filter coefficients, DC-feed data and supervision data are easily calculated with the WinSLAC™ software. This PC software is provided free of charge. It allows the designer to enter a description of system requirements. WinSLAC then computes the necessary coefficients and plots the predicted system results.

The Am79R241 interface unit inside the ISLAC device processes information regarding the line voltages, loop currents and battery voltage levels. These inputs allow the ISLAC device to place several key Am79R241 performance parameters under software control.

The main functions that can be observed and/or controlled through the ISLAC device backplane interface are:

- DC-feed characteristics
- Ground-key detection
- Off-hook detection
- Metering signal
- Longitudinal operating point
- Subscriber line voltage and currents
- Ring-trip detection
- Abrupt and smooth battery reversal

- Subscriber line matching
- Ringing generation
- Sophisticated line and circuit tests

To accomplish these functions, the Am79R241 device collects the following information and feeds it, in analog form, to the ISLAC device:

- The metallic and longitudinal loop currents
- The AC and DC loop voltage

The outputs supplied by the ISLAC device to the Am79R241 device are then:

- A voltage that provides control for the following high-level Am79R241 device outputs:
  - —DC loop current
  - —Internal ringing signal
  - —12 or 16 kHz metering signal
- A low-level voltage proportional to the voice signal
- A voltage that controls longitudinal offset for test purposes

The ISLAC device performs the codec and filter functions associated with the four-wire section of the subscriber line circuitry in a digital switch. These functions involve converting an analog voice signal into digital PCM samples and converting digital PCM samples back into an analog signal. During conversion, digital filters are used to band-limit the voice signals.

The user-programmable filters set the receive and transmit gain, perform the trans-hybrid balancing function, permit adjustment of the two-wire termination impedance and provide frequency attenuation adjustment (equalization) of the receive and transmit paths. Adaptive trans-hybrid balancing is also included. All programmable digital filter coefficients can be calculated using WinSLAC software. The PCM codes can be either 16-bit linear two's-complement or 8-bit companded A-law or µ-law.

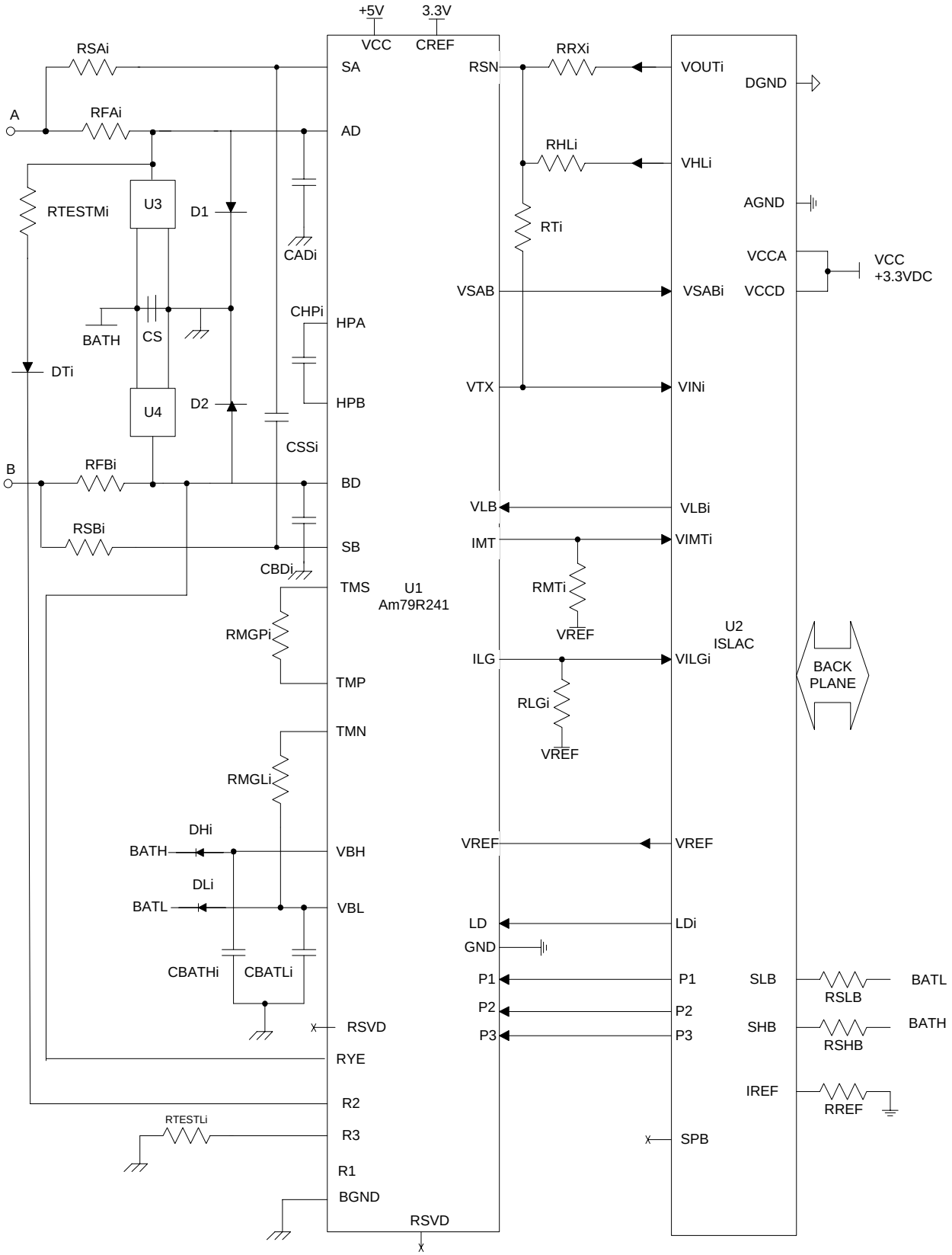
The ISLAC device supplies complete mode control of the Am79R241 device using the control bus and tri-level load signal.

The Intelligent Access voice chipset provides extensive loop supervision capability including off-hook, ring-trip and ground-key detection. Detection thresholds for these functions are programmable. A programmable debounce timer is available that eliminates false detection due to contact bounce.

For subscriber line diagnostics, AC and DC line conditions can be monitored using built-in test tools. Measured parameters can be compared to programmed threshold levels to set a pass/fail bit. The user can choose to send the actual PCM measurement data directly to a higher level processor by way of the voice channel. Both longitudinal and metallic resistance and capacitance can be measured, which allows leakage resistance, line capacitance, and telephones to be identified.

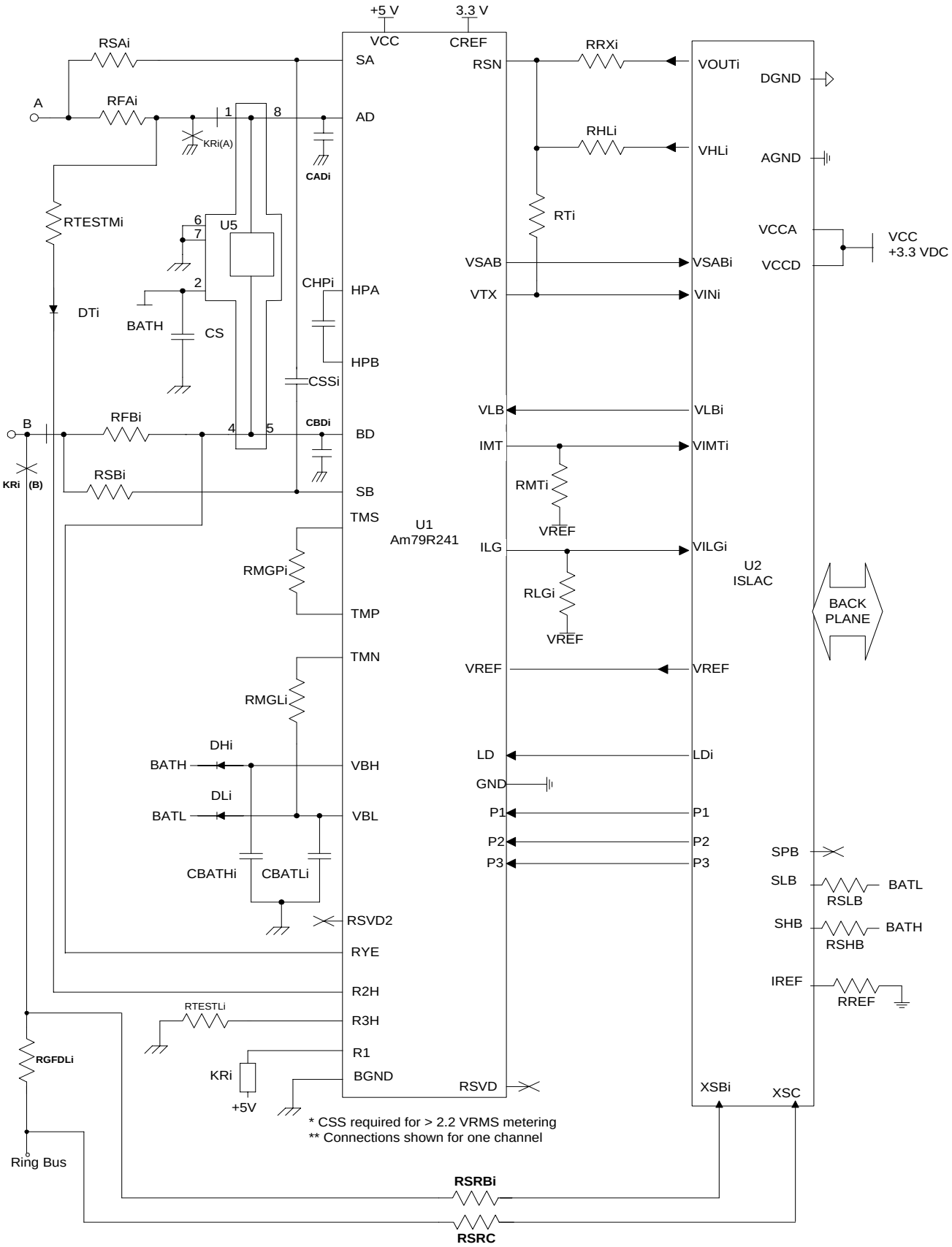
INTELLIGENT ACCESS VOICE CHIPSETS LINECARD WITH Am79R241

Figure 3. Internal Ringing Linecard Schematic



* CSS required for > 2.2 VRMS metering
** Connections shown for one channel

Figure 4. External Ringing Linecard Schematic



LINECARD PARTS LIST

The following list defines the parts and part values required to meet target specification limits for channel i of the linecard (i = 1,2,3,4).

Item	Type	Value	Tol.	Rating	Comments
U1	Am79R241				ISLIC device
U2	Am79X22xx				ISLAC device
U3, U4	P1001SC			100 V	TECCOR Battrax protector
U5	TISP61089			80 V	Transient Voltage Suppresser, Power Innovations
D1, D2	Diode	1 A		100 V	
DHi, DLi, DTi	Diode	100 mA		100 V	50 ns
RFAi, RFBi	Resistor	50 Ω	2%	2 W	Fusible PTC protection resistors
RSAi, RSBi	Resistor	200 kΩ	2%	1/4 W	Sense resistors
RTi	Resistor	80.6 kΩ	1%	1/8 W	
RRXi	Resistor	100 kΩ	1%	1/8 W	
RREF	Resistor	69.8 kΩ	1%	1/8 W	Current reference
RMGLi, RMGPi	Resistor	1 kΩ	5%	1 W	Thermal management resistors
RSHB, RSLB	Resistor	750 kΩ	0.5%	1/8 W	
RHLi	Resistor	5.1 kΩ	0.5%	1/8 W	
RMTi	Resistor	3.01 kΩ	0.5%	1/8 W	
RLGi	Resistor	6.04 kΩ	0.5%	1/8 W	
RTESTMi	Resistor	2 kΩ	1%	1 W	Metallic test
RTESTLi	Resistor	2 kΩ	1%	1 W	Longitudinal test
CADi, CBDi [1]	Capacitor	22 nF	10%	100 V	Ceramic, not voltage sensitive
CBATHi, CBATLi	Capacitor	100 nF	20%	100 V	Ceramic
CHPi	Capacitor	22 nF	20%	100 V	Ceramic
CSi[1]	Capacitor	100 nF	20%	100 V	Protector speed up capacitor
CSSi[3]	Capacitor	56 pF	5%	100 V	Ceramic
Components for External Ringing					
RGFDi	Resistor	510 Ω	2%	2 W	1.2 W typ
RSRBi, RSRc	Resistor	750 kΩ	2%	1/4 W	Matched to within 0.2% for initial tolerance and 0 to 70° C ambient temperature range.[2] 17 mW typ
KRi	Relay	5 V Coil			DPDT

Notes:

1. *Value can be adjusted to suit application.*
2. *Can be looser for relaxed ring-trip requirements.*
3. *Required for metering > 2.2 Vrms, otherwise may be omitted.*